



GENI

GRID HARDWARE & SOFTWARE

PROJECTS:	15	FUNDING YEAR:	2011
TOTAL INVESTMENT:	\$39.4 million	PROGRAM DIRECTOR:	Dr. Tim Heidel
PROJECT DETAILS:	www.arpa-e.energy.gov/ProgramsProjects/GENI.aspx		

PROGRAM

The 15 projects in ARPA-E's GENI program, short for "Green Electricity Network Integration," aim to modernize the way electricity is transmitted in the U.S. through advances in hardware and software for the electric grid. These advances will improve the efficiency and reliability of electricity transmission, increase the amount of renewable energy the grid can utilize, and provide energy suppliers and consumers with greater control over their power flows in order to better manage peak power demand and cost.

INNOVATION NEED

The aging U.S. electric grid is comprised of over 300,000 miles of electric transmission lines that take electricity from power plants to transformers and finally, into homes and businesses. Over 30% of the grid's transmission lines, transformers, and other hardware are approaching or past the end of their life cycle. Around 10% of the electricity produced in U.S. power plants never reaches potential users because it's lost during transmission, and power outages and blackouts throughout the grid cost businesses and consumers almost \$80 billion dollars a year.

GENI GOALS

- Stronger and more reliable electric grid
- Flexibility to dispatch power in real-time
- Enable 10x more renewable energy

Historically, the electric grid was designed to be a passive, one-directional system—much like the aqueducts built by the Romans, which could transport water anywhere, as long as it went downhill. To improve the grid's reliability and turn intermittent power sources like solar and wind into major contributors to the U.S. energy mix, we have to think about the grid differently and design it to be smarter and more flexible. GENI projects are focused on advances in both grid hardware and software that will help modernize the existing grid—making it smarter, more secure, and more reliable. GENI hardware advancements, such as power flow controllers made of advanced materials, would more efficiently direct the flow of power on the grid, help stem energy losses, and enable the grid to be more responsive and resilient. GENI software technologies would leverage advancements in computing and data communications to optimize grid operations, match power delivery to real-time demand, and find effective ways to manage sporadically available renewable power sources and grid-level power storage.

POTENTIAL IMPACT

If successful, GENI projects would significantly improve the efficiency, security, and reliability of the U.S. electric grid.

- **SECURITY:** A more efficient and reliable grid would be more resilient to potential disruptions from failure or attack.
- **ENVIRONMENT:** A smarter grid could enable the integration of 10x more wind and solar power—substantially reducing carbon dioxide (CO₂) emissions in the U.S., 40% of which are produced by electricity generation.
- **ECONOMY:** A more efficient and reliable grid would help protect U.S. businesses from costly power outages and brownouts that stop automated equipment, bring down servers, and crash computers.
- **JOBS:** Advances in grid hardware and software could result in new high-paying jobs in industries like engineering and information technology.